REMARKS

Claims 1, 2, 4-16 and 18-22 remain pending in this patent application.

In this paper, claims 1, 2, 5, 6, 9, 13, 14, 16 and 20 have been amended. Support for the amendments to independent claims 1, 5, 6, 9, 13, 14, 16and 20 can be found in the specification on page 4, line 35, through page 5, line 4, on page 16, lines 26-27, and in drawing Figs. 1(b) and 1(c). Non-limiting editorial amendments to the claims have also been made for enhanced clarity of the recited subject matter.

PRIOR ART REJECTION I

Claims 1, 2, 4, 5, 13-16 and 18-20 were rejected under 35 USC § 103(a) as being unpatentable over US 2004/0105473 A1 (Tojo et al.) in view of US 2004/0213315 A1 (Kume et al.) and US 2002/0053676 A1 (Kozaki). Applicant traverses this rejection insofar as it might be deemed applicable to claims 1, 2, 4, 5, 13-16 and 18-20 as now presented.

Amended independent claims 1, 2, 5, 13, 14, 16 and 20 now require that an end surface protective film, "covers the stripe-shaped waveguide region or an emission-side of the end surface of the resonance." With such a configuration, the luminescent radiation or "excitation light" radiated from the substrate (such light is not only from the end-surfaces, but also from elsewhere, diffused and propagated from the end-surfaces) can be reduced, thus increasing light output. This advantage of Applicant's disclosed and claimed laser device is not disclosed or suggested, and cannot even be derived, from the references applied by the Examiner.

In paragraph 3 of the Office Action, the Examiner states, "Tojo et al. do not disclose: a nitride semiconductor substrate, ... However, Kozaki discloses: GaN substrate (101) (Figure 1, [0142]). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device of Tojo et al. by growing the laser device on a GaN substrate in order to prevent a large number of dislocations from forming during growth."

Applicant submits that the foregoing statements by the Examiner are technically incorrect. Tojo et al. specifically teaches reflective (protective) film provided on the end-surfaces of a laser device, the film having lower refractive index than the laser oscillation region which is GaN-based. More specifically, the refractive index is set lower than the GaN-based laser

oscillation region and higher than the sapphire substrate. Since Tojo et al. specifically defines the relationship of three refractive indices of the substrate, laser oscillation region (semiconductor layer) and protective film, it would be a violation of the explicit teachings in Tojo et al. to substitute the sapphire substrate with GaN substrate, which has different refractive index, and thus would not maintain the essential relationship of the three refractive indices. That is, Tojo et al. specifically teaches a trinity of the substrate, semiconductor layer and protective film, having different refractive indices, respectively, and there is no basis for the Examiner's apparent proposal to combine such an arrangement with a homogeneous-structure such as a GaN substrate/GaN semiconductor grown thereon. Even if the sapphire substrate were modified, or replaced by a GaN substrate, then the GaN substrate and the GaN semiconductor layer (laser oscillation region) would have similar or the same refractive indices, and could not form the required end-surface construction required by Tojo et al.

In paragraph 6, the , the Examiner states, "Tojo et al. do not disclose: ... luminescent radiation region that absorbs light emitted from the active layer and emits luminescent radiation with a wavelength longer than the wavelength of the emitted light, ...Kume et al. disclose: absorbing layer (15A) that absorbs light emitted from the active layer(17) (Figure 1, [0067]). It is inherent that the absorbing layer will emit luminescent radiation after absorbing light from the active layer and the emitted radiation will be a longer wavelength than the wavelength of the emitted light. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device of Tojo et al. by incorporating an absorbing layer into the substrate in order to prevent the leakage of spontaneous emission. It would also have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device of Tojo et al. by modifying the reflectivity the one of the protective films so that the reflectivity is higher for the wavelength of the luminescent radiation in order to prevent the leakage of spontaneous emission." The Examiner continues, "[I]t would also have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device of Tojo et al. by modifying the reflectivity the one of the protective films so that the reflectivity is higher for the wavelength of the luminescent radiation in order to prevent the leakage of spontaneous emission." Presumably, such "leakage of spontaneous emission"

means laser light from the active layer and the luminescent radiation from the luminescent radiation region (the Examiner appears to rely on Kume's definition of "spontaneous-emission-absorbing layer 15A" as a radiation region). However, the Examiner has not identified which reference discloses such "leakage of spontaneous emission," and the basis for the rejection is thereby flawed.

Tojo et al. is based on a heterogeneous structure between the substrate and the semiconductor layer grown thereon, utilizing such hetero-structual interfaces to be formed between the substrate and protective film and the semiconductor layer and protective film, while the present invention focuses on the excitation light. Applicant submits that Tojo et al. teaches away from the present invention that incorporates a homogeneous structure of the substrate and semiconductor layer (laser oscillation region) grown thereon. Even if one of ordinary skill in the are were to apply the teachings in Kume et al. Tojo et al., the modification would be limited to one interface between the substrate and protective film, matching an excitation light, while the interface between the semiconductor layer and protective film could not be adjusted. Consequently, Applicant's disclosed and claimed construction could not be attained.

Kume et al. disclose a saturable absorbing layer 15A that absorbs spontaneous emission emitted from the active layer. This absorbing layer 15A would be saturated at a certain amount of absorption; thereafter, the emission would turn to the transparent layer, which could not prevent leakage of the spontaneous emission to the outside. This is why Kume et al. employs insulating film 31. In other words, Kume et al. does not offer a solution to the problem solved by Applicant's disclosed and claimed invention, i.e., "a nitride semiconductor laser device that suppresses deterioration of FFP due to stray light emitted from an end surface on the emission side to provide excellent beam characteristics, and does not improperly operate, and additionally have excellent life characteristics," as disclosed in paragraph [0007] of the Applicant's specification.

As disclosed in paragraph [0035] of Applicant's specification, the claimed laser device "absorbs stray light inside the substrate, and thus suppresses FFP deterioration due to mixture of the stray light into laser light. In addition, the laser device absorbs the stray light and emits luminescent radiation, and has a high reflective end surface protective film formed therein such

that the luminescent radiation is not emitted outward. Therefore, the laser device can provide more stable laser light. Furthermore, a high reflective end surface protective film is also formed on the rear side to prevent improper operation of a detector due to the luminescent radiation with a wavelength longer than light emitted from the active layer, thus, precise driving control can be obtained. Therefore, it is possible to provide an excellent reliable semiconductor laser device."

The generation of stray radiation caused by the nitride semiconductor substrate is a specific problem in the use of the nitride semiconductor substrate that was identified by the inventors of this application. The references applied by the Examiner do not consider this problem, much less offer any proposals for providing a solution to the problem.

More specifically, claimed limitations of (1) the nitride semiconductor substrate having a luminescent radiation region and (2) one of the end surface protective films having a higher reflectivity for the wavelength of the luminescent radiation from the luminescent radiation region, and having a lower reflectivity for the wavelength of the emitted light from the active layer, are not disclosed or suggested by the references. That is, the claims call for differentiating the reflectivity of the end surface protective films, i.e., higher for the luminescent radiation and lower for the active layer. Such differentiation is not taught or suggested by any of the applied references.

The inventors of the invention disclosed and claimed in this application found that the stray radiation was caused by the nitride semiconductor substrate and to reduce or avoid such stray radiation, the present invention employs specific structure, i.e., "at least one of the end surface protective films has a higher reflectivity for the wavelength of the luminescent radiation from the luminescent radiation region, and have a lower reflectivity for the wavelength of the emitted light from the active layer." By employing such specific configuration, the invention performs advantageous results, i.e., the leakage of light from the waveguide region (stray radiation) is reduced thus the far-field pattern would not be disturbed with noise caused by stray light, achieving an excellent beam characteristics, while the output light would not blocked and it can be effectively retrieved or outputted from the laser device. In particular, the claimed configuration does require a non-transparent film that prevents the stray light from passing through the waveguide region, rather, providing the end surface protective film having higher

reflectivity for a wavelength that is converted and is longer than the stray light, and the mixture of noise in laser light is suppressed therefore, as set forth in [0009]. These superior results are not attained by devices disclosed in any of the applied references.

In view of the foregoing observations, Applicant submits that no reasonable combination of the disclosures in Tojo et al., Kume et al. and Kozaki can properly serve as a basis for rejecting Applicant's amended independent claims 1, 2, 5, 13, 14, 16 and 20, or any of the claims that depend from them, under 35 USC § 103(a).

PRIOR ART REJECTION II

Claims 6-12 were rejected under 35 USC § 103(a) as being unpatentable over Tojo et al. in view of Kume et al., Kozaki and US 6057565 (Yoshida et al.). Applicant traverses this rejection insofar as it might be deemed applicable to claims 6-12 as now presented.

Like independent claims 1, 2, 5, 13, 14, 16 and 20, claims 6, 9 and 10 have been amended to require that an end surface protective film, "covers the stripe-shaped waveguide region or an emission-side of the end surface of the resonance."

The Examiner cites Yoshida et al. for its disclosure, in column 14, lines 1-12, of a multi-layer reflective film used to improve reflection factor on the laser emission surface. The Examiner contends, apparently in view of the Yoshida et al. teachings, that it would have been obvious to modify the Tojo et al. device by adding reflective films with higher reflectivity on the rear side end surface and on the emission side end surface.

Without acquiescing in the Examiner's proposal to combine the teachings in Yoshida et al. with those in Tojo et al., Kume et al., Kozaki, Applicant notes that Yoshida et al. offers no remedy for deficiencies in the Tojo et al., Kume et al., Kozaki vis-à-vis the requirements of the amended independent claims, as pointed out above. Accordingly, even if the Tojo et al.-Kume et al.-Kozaki device were modified as proposed by the Examiner, the resulting device could not meet the requirements of Applicant's claims 6-12 and could not realize the advantages of Applicant's disclosed and claimed invention.

In view of the foregoing observations, Applicant submits that no reasonable combination of the disclosures in Tojo et al., Kume et al., Kozaki and Yoshida et al. can properly serve as a

basis for rejecting Applicant's amended independent claims 6, 9 and 10, or any of the claims that depend from them, under 35 USC § 103(a).

PRIOR ART REJECTION III

Claims 21 and 22 were rejected under 35 USC § 103(a) as being unpatentable over Tojo et al. in view of Kume et al., Kozaki and US 2002/0141321 A1 (Wada et al.). Applicant traverses this rejection insofar as it might be deemed applicable to claims 21 and 22 as now presented.

The Examiner cites Wada et al. for its disclosure of a GaN laser device optically coupled to a photodetector. The Examiner contends, apparently in view of the Wada et al. teachings, that it would have been obvious to modify the Tojo et al. device by coupling a photodetector to the laser device.

Without acquiescing in the Examiner's proposal to combine the teachings in Wada et al. with those in Tojo et al., Kume et al., Kozaki, Applicant notes that Wada et al. offers no remedy for deficiencies in the Tojo et al., Kume et al., Kozaki vis-à-vis the requirements of the amended parent claims 1 and 5, as pointed out above. Accordingly, even if the Tojo et al.-Kume et al.-Kozaki device were modified as proposed by the Examiner, the resulting device could not meet the requirements of Applicant's claims 21 and 22 and could not realize the advantages of Applicant's disclosed and claimed invention.

In view of the foregoing observations, Applicant submits that no reasonable combination of the disclosures in Tojo et al., Kume et al., Kozaki and Wada et al. can properly serve as a basis for rejecting Applicant's claims 21 and 22, as now presented, under 35 USC § 103(a).

CONCLUSION

In view of the amendments, observations and arguments presented herein, Applicant respectfully requests that the Examiner reconsider and withdraw the rejections stated in the outstanding Office Action and recognize all of the pending claims as allowable.

If unresolved matters remain in this application, the Examiner is invited to contact Frederick R. Handren, Reg. No. 32,874, at the telephone number provided below, so that these matters can be addressed and resolved expeditiously.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.147; particularly, extension of time fees.

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Respectfully submitted,

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